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Original Article

A comparison of clinical-scenario (case cluster) versus stand-alone multiple choice questions in a problem-based learning environment in undergraduate medicine

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الملخص

أهداف البحث: المقارنة بين عناصر الأسئلة متعددة الاختيار "القائمة بذاتها" وبين عناصر أسئلة "السيناريو السريري" المدمجة متعددة الاختيار (الحالة المتراكبة) في بيئة التعلم القائم على حل المشاكل.

طرق البحث: تم إجراء تحليل وصفي استرجاعي على امتحانات متعددة الاختيار في مقرر يدمج تخصصات علم الأمراض التشريحي، وعلم الأمراض الكيميائي، وعلم أمراض الدم، وعلم المناعة، وعلم الأحياء الدقيقة وعلم الصيدلة. تم تحليل عناصر الأسئلة متعددة الاختيار من ناحية الموثوقية (كودر-ريتشاردسن-٢٠) ومستوى الصعوبة، ومؤشر التميّز، وصارفات الانتباه عن العنصر وأداء الطلاب. استخرجت التحاليل الإحصائية للنتائج من برنامج تحليل سلامة العنصر المتوفر على الانترنت. تم بعد ذلك مقارنة نتائج الأسئلة متعددة الاختيار "القائمة بذاتها" مع نتائج أسئلة "السيناريو السريري" المدمجة متعددة الاختيار (الحالة المتراكبة).

النتائج: كانت نتائج كودر- ريتشاردسن-٢٠ بالنسبة لأسئلة "السيناريو السريري" المدمجة متعددة الاختيار أعلى من نتائج الأسئلة متعددة الاختيار "القائمة بذاتها" على الدوام. وكانت قيم كودر- ريتشاردسن-٢٠ ومستوى الصعوبة أعلى بالنسبة لأسئلة "السيناريو السريري" المدمجة متعددة الاختيار. بالنسبة لمستوى الصعوبة ومؤشر التميّز، لم يكن هناك فرق ذو قيمة إحصائية بين أسئلة "السيناريو السريري" المدمجة متعددة الاختيار والأسئلة متعددة الاختيار "القائمة بذاتها". وكان هناك مجموعة من مستويات الصعوبة على تصنيف بلوم.

كما أن متوسط درجات الطلاب كان أعلى في امتحانات السيناريو السريري المدمجة متعددة الاختيار. وكان إعداد امتحانات "السيناريو السريري" المدمجة متعددة الاختيار أكثر تحديا.

الاستنتاجات: تضاهي امتحانات "السيناريو السريري" المدمجة متعددة الاختيار امتحانات الأسئلة متعددة الاختيار "القائمة بذاتها" وتوفر فرصا للدمج التكاملي بين التخصصات الفرعية والتقييم المتماشي مع طريقة التعلم المبنية على حل المشاكل. حيث تقوم بتقييم المهارات المعرفية للطلاب مع كونها موثوقة وعملية. وتشجع المستويات المختلفة من صعوبة العناصر فيها التفكير النقدي ومتعدد المنطق. كما كانت درجات الطلاب أعلى في امتحانات السيناريو السريري المدمجة متعددة الاختيار، الذي قد يشير إلى فهم أفضل للمادة، أو وضوح أكثر في السؤال. وينبغي على السيناريوهات أن تتتابع بصورة منطقية. كما أن زيادة عدد السيناريوهات يضمن فحصا أشملا لمحتوى المقرر.

الكلمات المفتاحية: السيناريو السريري؛ الصعوبة؛ التمييز؛ الدمج؛ التعلم المبني على حل المشكلة

Abstract

Objectives: To compare stand-alone multiple choice questions (MCQs) and integrated clinical-scenario (case cluster) multiple choice questions (CS-MCQs) in a problem-based learning (PBL) environment.

Methods: A retrospective descriptive analysis of MCQ examinations was conducted in a course that integrates the subspecialties of anatomical pathology, chemical pathology, hematology, immunology, microbiology and pharmacology. The MCQ items were analyzed for their reliability (Kuder–Richardson-20, KR-20), level of difficulty (Pi), discrimination index (Di), item distractors and student performances. The statistical analysis of the

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results was extracted from the integrity online item-analysis programme. The results of the standard stand-alone and CS multiple choice questions were compared.

Results: KR-20 for the CS-MCQs and stand-alone MCQs was consistently high. KR-20 and Pi were higher for the CS-MCQs. There was no significant difference between the CS-MCQs and stand-alone MCQs in Pi and Di. A range of difficulty levels was found based on Bloom's taxonomy. The mean scores for the class were higher for the CS-MCQ examination. The compilation of the CS-MCQ examination was more challenging.

Conclusions: CS-MCQs compare favorably to stand-alone MCQs and provide opportunities for the integration of sub-specialties and assessment in keeping with PBL. They assess students' cognitive skills and are reliable and practical. Different levels of item difficulty promote multi-logical and critical thinking. Students' scores were higher for the CS-MCQ examination, which may suggest better understanding of the material and/or better question clarity. The scenarios have to flow logically. Increasing the number of scenarios ensures the examination of more course content.

Keywords: Clinical scenario; Difficulty; Discrimination; Integration; PBL

Introduction

Problem-based learning (PBL) is one of the most accepted modes of curriculum delivery in medical schools.[1] It discourages students from simply obtaining basic factual knowledge[2] and encourages and emphasizes the integration of basic knowledge and clinical skills. One challenge for teachers is to design assessment strategies that are in line with the PBL philosophy.[1] Assessments should match the competencies that the students are to learn and the teaching format used.[1]

Currently, multiple choice question (MCQ) examinations are a widely accepted assessment modality. Convincing evidence by researchers shows that MCQs not only satisfy all psychometric characteristics (reliability, validity, objectivity, fairness and practicality) of testing but also assess higher-order thinking with precision. Practicality in terms of both human and material resources in planning and implementing a test is very important.[7] Some writers support the use of MCQs, whereas others[2] are of the view that for the most part, standard MCQs assess only factual knowledge or the use of information rather than deeper understanding of content or cognitive skills; thus, they are not always useful for PBL assessment.

Other authors state that well-written MCQs do assess higher-level cognitive skills, although creating these items requires more skill than the basic recall type of questions.[3,4] PBL content assessment using MCQs in combination with computer-based objective tests (COMBOT) was shown to be significantly reliable and well aligned with the major learning outcomes of PBL cases.[5] Essays or short answer questions (SAQs), while they may address deeper thinking and higher cognitive level skills, are time consuming and are associated with grading discrepancies and variations.[3] They are more difficult to grade.[8] The modified essay question (MEQ) examination, also known as progressive disclosure questions (PDQs), was introduced as a compromise between the essay/SAQ and MCQ.[3] However, some authors have shown that, while the intent was indeed to ask questions requiring higher-order cognitive skills, the PDQ examination questions actually required predominantly lower-order cognitive skills.[6,9] Some schools have introduced extended matching questions (EMQs) and others clinical scenario MCQs (CS-MCQs) (also known as "case clusters").[2,10–12]

CS-MCQs assess students in a similar way as MEQ/PDQs. In MEQ/PDQs, a clinical case is given and questions are asked based on the case. Each question may reveal further information progressively as required.[3] They test analytical skills, problem solving skills, cognition and the integration of knowledge. They encourage students to think not just about basic knowledge or individual systems but about the whole patient,[3] which better reflects the learning process[11] and also better prepares students to assess their patients when they become doctors in the future.[11] Further, compared to MEQ/PDQs, they have all the advantages of MCQs. They are easy and less time consuming for staff to grade and less time consuming for students to write. They examine more course-content in a short time, and have fewer problems associated with sampling as observed in MEQs/PDQs.[9] Indeed some researchers[6] have shown more item flows with MEQs than with MCQs.

When comparing MCQs preceded by clinical scenarios and exact items (based on the same exact topics), it was shown that while the time required to answer CS-MCQs increased by 20%, students perceived that in the integrated course, the clinical scenarios improved question clarity and increased relevance to the curriculum.[11] CS-MCQ tested the students' ability to synthesize information as well their clinical reasoning.[10] Indeed, medical education experts Case and Swanson in 2002 agreed that case-clusters are particularly important for PBL courses because they test the application of knowledge.[12] However, it is important in this format to be careful and avoid "cueing and hinging"[12]: no "hinging" unless the topic is so important that it is an "all or nothing".[12]

Quality control exercises are important for ensuring high-quality MCQs.[13] MCQ items can be analyzed qualitatively (for content validity, form, and effective writing procedures) and quantitatively (for statistical properties, which include a measurement of item difficulty (Pi), the item discrimination index (Di) and item distractors). MCQ items should be modified to have Pi and Di within acceptable ranges.[14] Effective items discriminate between high and low scorers throughout the test. Ideal items have the most high scorers passing and low scorers failing.[15–17]